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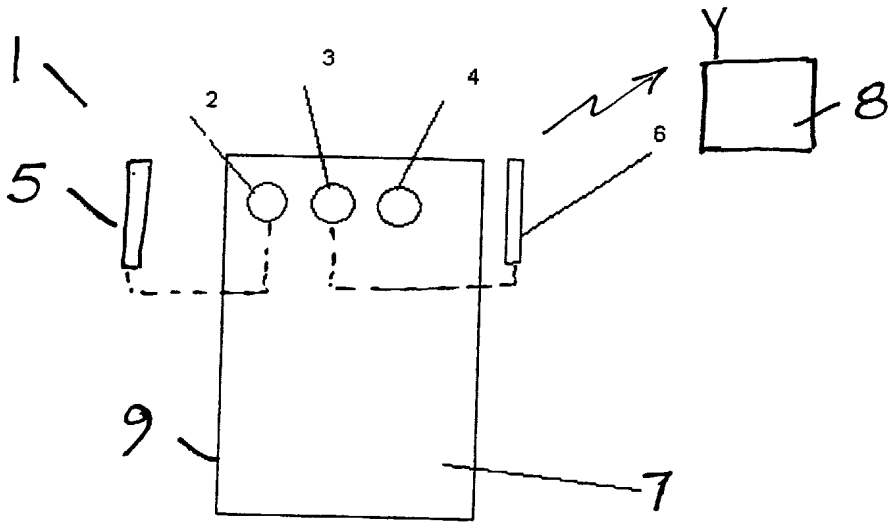

(57) Abstract: A vehicle monitoring system (1) has a vehicle mounted electronic device (7) and an associated remote monitoring station (8) which are interconnected by a communications link. The device (7) is connected to a GPS system which provides speed and location data for the vehicle which is independent of driver control. Additional data relevant to safe operation of the vehicle can also be collected. Some of the data is stored at intervals in the device (7) for later transmission to the remote monitoring station (8). The length of the intervals between data storage operations depends on the measured speed of the vehicle and the rate of change of speed of the vehicle. The data collected can be used to generate a report profile of the manner in which the driver drives the vehicle in order to calculate a suitable insurance premium for that driver.

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"Vehicle monitoring system"

Introduction

The present invention relates to a system and method for profiling operation of a vehicle over a period of time for insuring the vehicle comprising an electronic device located within the vehicle and communication means for communicating data to a profile database stored at a remote monitoring station.

Modern communication means enables vehicles to be connected to a central database. This database and its related applications enables separation of the vehicle control environment into two dimensions:

1. Inner Control
2. Outer Control

The inner control is managed by the vehicle manufacturer and is under heavy control by the various safety authorities. All the car control necessary are well supported today, for example – steering , braking, seatbelts, to name but a few, form part of the inner control of a vehicle and are not part of this invention. On the other hand, the outer control is a method, which enables vehicle users or owners to benefit by improving the safety of their vehicle. An example of outer control is a tachograph used by truck drivers, which records the amount of time the vehicle is mobile. However, the technology employed for a tachograph is very basic and does not provide a large amount of information relating to measurable parameters of the vehicle.

A problem with vehicles and associated parties is that it is widely recognised that certain groups of people, particularly young drivers, are a risk to themselves and other vehicles on roads. At present there is no way to monitor these drivers and inhibit them from driving dangerously, for example at high acceleration from 0-60 miles per hour, not adhering to speed limits in the area that they are driving in and carrying more weight than the vehicle is designed to carry. It is desirable to provide a system and method which profiles operators of vehicles for calculating insurance for the vehicle

and driver.

Statistics show that speeding is one of the prominent causes of fatalities and injuries on roads. Further, because certain groups of people can be categorised when driving vehicles insurance rates are much higher, for example for a young male single driver irrespective of how responsible the driver is on the road. A problem for these young drivers is that there is no effective solution or device developed to date to effectively monitor operation of vehicles and provide an accurate calculation of the insurance of the vehicle based on driver profiles.

Various solutions have been proposed to estimate the insurance of vehicles depending on driver performance. One such example is disclosed in US Patent No. 6, 064, 970 to McMillan et al. This US patent discloses a method of determining a cost of vehicle insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics by monitoring a plurality of raw data elements representative of the operating state of the vehicles in response to the action of the operator. However a problem with the system described in this US patent is that it is bulky, expensive and difficult to install in the vehicle. It requires a computer to essentially communicate with three onboard vehicle devices for acquisition of information. The system disclosed in this US patent also suffers from the problem that the processing requirements for the hardware is computationally intensive.

US Patent Publication No. US 2002/0173881 Lash et al. discloses a system for monitoring the speed of a vehicle in relation to a posted speed limit using a global positioning system (GPS) receiver, used to receive conventional positioning data from a GPS satellite network to measure the location and speed of the vehicle. However this US publication is only directed towards informing the driver what speed they are doing in a particular speed limit and to inform the driver visually or audibly that they are exceeding the speed limit. Further, the GPS map is stored on the device in the vehicle which requires a large memory and is difficult to update.

Other examples of wireless intelligent vehicle speed controller monitoring systems are disclosed by US Patent No. US 6,246,948 Thakker. However this US patent does not

disclose monitoring means for calculating insurance purposes and profiling drivers of vehicles. US Patent No. 6,141,611 Mackey et al., discloses a mobile vehicle accident data system incorporating a camera in the vehicle which records and stores data of images of a vehicle as it is moving. This data can be used in the event of an accident. However the system disclosed by this US patent is bulky and expensive and difficult to install.

It is an object of the present invention to provide a solution to the above-mentioned problems by providing a system and method to profile drivers of vehicles and to effectively calculate an insurance premium for the vehicle in response to the manner in which the driver drives the vehicle. The invention is further directed towards reducing the number of accidents on roads today and providing essential information at the time of an accident.

Statements of Invention

According to the invention there is provided a method of profiling operation of a vehicle over a period of time for insuring the vehicle comprising an electronic device located within the vehicle and communication means for communicating data from the electronic device to a profile database stored at a remote monitoring station comprising the steps of:

monitoring a plurality of parameters representative of an operating state of the vehicle, said parameters including the location of the vehicle and the corresponding speed of the vehicle at said location, said measured speed and location data being determined using a GPS receiver independent of vehicle operator control, said parameters being measured at selected time intervals,

storing the measured parameter data for the vehicle at each time interval in the electronic device;

establishing a communication link between the electronic device and the remote monitoring station;

transmitting the stored measured parameter data for each time interval to the remote monitoring station;

generating a report profile of the vehicle operation from the transmitted data; and

calculating from the report profile an insurance premium for insuring the vehicle.

An important advantage of the invention is that as the data is recorded via GPS the data is completely independent of the vehicle itself which prevents any unauthorised tampering with the data or sensors for collecting the data. It will be appreciated that the determined location and speed of the vehicle can be compared to an electronic map with different speed limit locations to determine whether the vehicle is speeding in a particular location, and this can be either done in real time or recorded for later review.

Various other embodiments of the invention are as described in the claims of this patent specification.

In another embodiment the system includes a modular electronic device comprising an ectronic circuit, a GPS (Global Positioning System) receiver, a computer means and a RF (Radio Frequency) communication means.

Preferably, an RF (Radio Frequency) communication means transmits stored data to a central monitoring station, via GPRS, SMS or GSM. If the chosen communication method is GPRS then the unit would be in constant communication with a central monitoring station allowing real time data analysis. This also means that a message or text can be sent to the driver of the vehicle in real time. Such information can be in an audio or text format to a display unit connected to the device in the vehicle.

In another embodiment there is provided a modular electronic device for a vehicle, including:

an electronic circuit operatively connected to a GPS receiver;

means for sensing and storing data relating to the vehicles position and speed via the GPS receiver;

means for measuring and storing data relating to the weight of the vehicle;

communication means, for transmission of the stored data to an associated computer at a remote central monitoring station;

said computer having means for analysing the location of the vehicle and the maximum weight and speed allowed for the vehicle at said location from a predetermined electronic map stored by the computer.

In another embodiment there is provided a modular electronic device for a goods vehicle for carrying a liquid cargo comprising:

an electronic circuit operatively connected to a GPS receiver;

means for sensing and storing data relating to the vehicle's position and speed via the GPS receiver;
means for measuring and storing data relating to the amount of liquid cargo that the vehicle is carrying;

communication means for transmission of stored data to an associated computer at a remote central monitoring station;

said computer having means for analysing the location of the vehicle, and the amount of liquid cargo and the vehicle speed allowed at said location from a predetermined electronic map stored by the computer.

Further, means may be provided such that the temperature of the liquid can be measured and stored for analysis. For example, it is possible to monitor the liquid during transit as well as determining whether the vehicle has exceeded the speed limit

at a particular location.

In a further embodiment of the present invention there is provided a modular electronic device for vehicles comprising;

an electronic circuit operatively connected to a GPS receiver.

means for determining and storing data relating to the time the vehicle has spent on the road via the GPS receiver;

means for determining and storing data relating to the time the vehicle has spent parked and the location via the GPS receiver;

means for determining and storing data relating to the distance travelled by the vehicle;

communication means for transmission of the stored data to an associated computer at a central monitoring station;

said computer having means for analysis of the position of the vehicle and the amount of driving time recorded.

In another embodiment the system may include a camera means or other image sensor means such as a CCD element for mounting on the vehicle and means for storing images generated by the camera means. Said images could be stored locally on the vehicle for later retrieval or could be transmitted immediately or at timed intervals to a remote central monitoring station. It will be appreciated that various communication methods may be employed for example USB, Ethernet, RF Local Communication, Blue Tooth. Individual images may be recorded, for example a picture is taken every second or every few seconds. The images could be stored in the internal memory of the vehicle mounted device. If a sudden acceleration or deceleration of the vehicle occurs a sequence of pictures relating to the event may be transmitted to the computer in the remote central monitoring station, via cellular technology for example, or are stored in the vehicle mounted device to be downloaded

at a later time.

In another arrangement continuous visual images can be generated by a video camera and recorded over a period. The recordal could for example overwrite previously stored video images over a period of time until a sudden acceleration or deceleration of the vehicle occurs. This event would store the video images relating to the event and then stop recording before erasing or overwriting these images. For example should the vehicle be involved in a collision the recorded images could be read directly via RS232 communication port, Blue Tooth, IR or other methods for later investigation. The number of CCD elements, or C-MOS technology can be varied according to the application and the system cost.

In a further embodiment means may be provided for sensing health parameters of the driver and for recording and/or onward transmission of any recorded data. For example, ECG, blood sugar level, hypertension and other data relating to the driver may be recorded.

Detailed Description of the Invention

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a diagrammatic view of a vehicle monitoring system according to the invention;

Fig. 2 is a schematic of an electronic device of the monitoring system;

Fig. 3 illustrates a mother board of the electronic device with associated GPS and cellular modem connection;

Fig. 4 is a schematic of the mother board of the device;

Fig. 5 is a collection of tables illustrating a sample vehicle operation profile

report;

Fig. 6 is a view similar to Fig. 2 showing another electronic device for the vehicle monitoring system.

Referring initially to Fig.1 there is illustrated a vehicle monitoring system according to the invention indicated generally by the reference numeral 1. The system 1 includes a vehicle mounted electronic device 7 and an associated remote monitoring station 8 which are interconnected by a communications link. The device 7 has a sealed casing 9 which is waterproof. A first connector 2 is provided for connection with a GPS antenna 5. A second connector 3 is provided for connection to a communication antenna 6. A terminal 4 is provided for connection with a power supply (not shown) which may conveniently be the power supply for the vehicle on which the device 1 is mounted or possibly a separate battery.

Referring now to Fig. 2 there is provided a schematic of the electronic circuit of the device 1 indicated generally by the reference numeral 10. An optional display panel 11, which if used can be visually seen by the vehicle driver is connected to a system controller board 12. An optional sensor board 13, which measures various operational parameters of the vehicle if used is connected to the system controller board 12. The system controller board 12 comprises means for storing selected measured parameters associated with operation of the vehicle. The system controller board 12 is connected to a cellular communication board 14 and a GPS board 15, the operation of which will become readily apparent.

Figs. 3 and 4 show in more detail portions of the electronic device. Fig. 3 is a drawing illustrating the GSM modem 14, the GPS receiver 15 and the motherboard 12. It shows the motherboard 12 communicating with the GPS receiver 15 and the GSM modem 14. The motherboard 12 communicates with the two boards 14, 15 via serial communication. The motherboard 12 communicates with the GPS every 1.024 seconds and using it's onboard logic will decide to write a record or not.

Fig. 4 is a drawing of the motherboard 12. It shows the connector to the GPS receiver 15 and the GMS modem 14. It shows the application connector 17 which can be used

to connect to external devices in the vehicle so that it is possible to optionally record if the brake was pressed for example. The microcontroller is where the processing takes place. The programming connector is used to update the software in the unit. The Non Volatile memory is where the data is stored. This can be up to 16mb. The RS232 connector allows us to connect a PC or laptop directly to the unit for direct communication.

Fig. 5 shows various tables illustrating vehicle operation in a sample report profile generated by the system during operation of the system.

Referring to Fig. 6 there is shown another electronic device indicated generally by the reference numeral 30. This is largely similar to the device 1 shown in Fig. 2 and like pats are assigned the same reference numerals. In the device 30 of Fig. 6 there is also shown a camera 16 connected to the system controller board 12. This camera 16 is optional, and when used it is mounted on the vehicle and is operable to generate visual images in the manner described previously. Said visual images may be stored in the device 1 for later retrieval or may be transmitted to a remote central monitoring station. Individual images may be recorded, for example a picture is taken every second or every few seconds. The images could be stored in the internal memory of the vehicle mounted device. These could be continuously overwritten during normal operation of the vehicle. If however sudden braking of the vehicle occurs a sequence of pictures relating to the event is stored in the vehicle mounted device 1 to be downloaded at a later time or transmitted to the remote monitoring station.

In operation, the system controller board 12 collects data continuously from the GPS receiver board 15 associated with a GPS system and stores selected data. Upon a predefined event or time the collected data is transmitted to a remote or secure database, in the remote monitoring station 8 for example, by the cellular communication board 14. Data relating to the location of the vehicle and the speed at which the vehicle is travelling at that location is generated continuously by means of the GPS receiver 15, being updated approximately every second. The system controller board 12 receives the information from the GPS receiver 15 and stores selected information at spaced time intervals which preferably depend on the speed of the vehicle and/or acceleration or deceleration of the vehicle. Thus for example if the

vehicle is stationary then the location data may be only collected every minute whereas if the speed is in the order of 60 miles per hour then the speed and location data may be polled every twenty seconds.

The GPS receiver 15 is polled by the system controller board 12 roughly every second. The system controller board 12 selects data for storage. This is done in response to the measured speed of the vehicle and also in response to the determined acceleration or deceleration of the vehicle during harsh braking for example. If the vehicle is stationary or only moving slowly there will be relatively long intervals between each sequential set of data values stored, for example the interval might be in the order of sixty seconds. As vehicle speed increases the interval is reduced – for example if vehicle speed is in the order of twenty to thirty miles per hour the interval might be thirty seconds, for a vehicle speed of thirty to forty miles per hour the interval might be twenty five seconds, for a speed of forty to sixty miles per hour the interval might be twenty seconds and so on with the interval reducing as the vehicle speed increases. When harsh braking is detected, which may indicate the possibility of an accident for example, all the data received from the GPS receiver 15 may be collected and stored in the device 7 for later retrieval.

A communication link may be established between the electronic device 1 and the remote monitoring station 8 in a number of ways. In a first embodiment the communication is via a standard dialup connection. The monitoring station 8 stores in a table within a database all the identifiers of the electronic devices 1 that it is responsible for polling. The identifier is simply the GSM phone number assigned to a SIM card contained in each electronic device 1 to identify each vehicle. A server at the monitoring station 8 dials all the electronic devices 1 in rotation. If the data is successfully received by the server from an electronic device 1 then it stores the data in a database and changes the field "contact" within the database to the next due date. It then instructs the local electronic device 1 in the vehicle to erase the data. If is was unsuccessful it will go into a retry queue which is gone through when the server gets through all the other units. If it cannot contact the electronic device 1 in the vehicle at all then it will write this to an error log which will be checked by the operator.

In a second method the communication between the electronic device 1 and the

remote monitoring station 8 is via an SMS system (Short Message Service). The server at the remote monitoring station 8 sends a request by SMS to the electronic device 1 in the vehicle. The electronic device 1 in the vehicle then sends its current stored GPS record back to the server at the remote monitoring station 8. The server at the remote monitoring station 8 can also request the last six GPS records. The electronic device 1 in the vehicle transmits this information back to the server at the remote monitoring station 8 in a compressed SMS message.

In a third communication method the electronic device 1 communicates with the remote monitoring station 8 via a GPRS system. This operates in a fashion substantially similar to that described for the dialup method described previously. However instead of a phone number the remote monitoring station 8 stores a designated internet address of each vehicle mounted electronic device 1 in a database. Using this method it is possible for the remote monitoring station 8 to contact hundreds of vehicle mounted electronic devices 1 at the same time. The only limit on the amount of electronic devices 1 would be the bandwidth available to the server.

When the data has been uploaded to the remote monitoring station 8 each speed and associated location measurement is compared with a datum GPS map which has a designated maximum speed for each location on the map. Various comparison tables can then be prepared as shown in Fig. 5 to compare the actual driving speed of the vehicle with the maximum permitted speed at any given location where a measurement was taken. Typical data comparisons are illustrated in the tables shown in Fig. 5. This enables a report profile of the vehicle operation to be prepared from the transmitted data. From these report profiles an insurance premium for insuring the vehicle can then be calculated.

As can be seen in the various tables in Fig. 5 various different comparisons can be made. For example table 1 gives a general driving profile on the basis of percentage time spent driving within or above the maximum speeds for given locations. Table 2 compares the speeds actually driven with the related maximum speed allowed at the measured locations. Table 3 gives a log of when the vehicle is in motion. Table 4 gives a similar log indicating when and where the vehicle was parked. Table 5 records

incidences where the vehicle was suddenly accelerated and table 6 shows when harsh braking of the vehicle was carried out. Table 7 shows areas in which the vehicle was driven and the percentage time spent in each area. Table 8 gives a graph of the speed profile of the vehicle over a given period. Table 9 shows a table of data collected. Table 10 gives a map with a route travelled by the vehicle indicated on the map.

Further data such as personal and medical data from the passengers or the driver of the vehicle can also be collected, stored and transmitted. Additional parameters such as direction of the vehicle, location, weight of the vehicle and other parameters can also be collected and stored. The information can be transmitted to the remote monitoring station 8 by the communication board 14 using standard RF communication or one of the previously mentioned communication methods.

The device 7 stores at predetermined intervals the vehicle's current location, speed, heading and other various different data as required. This additional data can be functions such as whether or not the vehicle lights are on, whether or not seatbelts are being worn, and can integrate with current systems in the vehicle such as the temperature in the compartment of a freezer unit or the amount of liquid being carried in a tanker. It could possibly even record the weight of a load or how many people are in the vehicle. These are just some of the possibilities for the type of data that can be recorded. The remote monitoring station 8 once a day contacts the vehicle mounted device 7. The monitoring station 8 then requests any information from the device 7 that has not been sent to the monitoring station 8 previously. This data is then analysed by the monitoring station software and a report is generated. The report is based on selected criteria depending on end user requirements. Typically for example the report may give information about speed limit infringements, area of main use, distance travelled, time vehicle is stationary, average speed, maximum load carried etc.

In an alternative arrangement the vehicle mounted device 7 stores at predetermined intervals the same data as mentioned previously but instead of dialling into the device 7 the device 7 sends this data back to the monitoring station 8 via SMS. It can be programmed to send this information at regular time intervals ranging from daily to

hourly or even every minute. The monitoring station 8 can also request information. This means that the monitoring station sends an SMS to the device 7 and the device 7 immediately responds with an SMS containing the last six records of recorded data. So if your interval was set at once an hour this would give the vehicle location every ten minutes. This allows vehicle tracking from any internet enabled device anywhere in the world. This would be the preferred mode if real time reports were required but not the level of detail required in the previously mentioned operating mode. The device 7 can also store the information as it does in the previously mentioned mode and this stored information is available to download if a more detailed report about a vehicle's activity for a particular period is required.

In regions where GPRS is available then the device 7 can take advantage of it. Using GPRS the device 7 can be "online" at all time allowing continuous and always instantly available data about the vehicle that the device 7 is installed in.

It will be appreciated that the device allows a vehicle's journey to be tracked and mapped. Also the driving habits of the driver can be monitored for:

(a) speed limit infringements,
(b) harsh braking,
(c) sudden acceleration,
(d) an overall determination of the driver's style.

Access to the data collected is possible via a telephone download.

The device 7 can be installed in a car and connected to the car electric system before the main switch. Only the GPS antenna would be exposed on the dashboard. When in sleep mode the system consumes less than 13 mA. The onboard local programming connector enables changing of the programme with laptop computer while the unit is installed in the vehicle.

Each device 7 has a unique number, the telephone number and SIM PIN code comprise this number. The SIM PIN code is an optional and for the basic unit the remote monitoring station 8 can gain access to all the data by means of the telephone

number of the device 7.

According to another embodiment of the invention there is provided a method of profiling operation of a vehicle over a period of time, including an electronic device located within the vehicle and communication means for communicating data between the electronic device and a database stored at a remote monitoring station, including:

monitoring a plurality of parameters representative of the operating state of the vehicles, said parameters including the location of the vehicle and the corresponding speed of the vehicle at said location, said measured speed and location data being determined using a GPS receiver independent of vehicle operator control, said parameters being measured at selected time intervals,

storing measured parameter data for the vehicle at selected time intervals in the electronic device,

establishing a communication link between the electronic device and the remote monitoring station,

transmitting the stored measured parameter data to the remote monitoring station. Preferably this data is used for generating a report profile of the vehicle operation from the transmitted data.

In another embodiment the invention provides a vehicle monitoring system including means to determine the location of a vehicle and to measure the speed of the vehicle at said location and means for determining the maximum speed allowable for the vehicle at said location.

An important aspect of the present invention is the measurement of speed of the vehicle and the use of the GPS board 15. The GPS board 15, which incorporates a GPS receiver checks the location and speed of the vehicle. At predefined intervals the speed of the vehicle is matched with the location of the vehicle. Therefore, when this information is downloaded for analysis the location of the vehicle can be compared

with an electronic map, which can determine what the speed limit is for that location. This is very advantageous in that a third party can analyse whether a vehicle was speeding, in for example a 30mph zone, at a particular time.

The invention further provides the ability to check that a driver is driving within the safe parameters predefined, such as the time taken to go from 0 – 60mph and if the speed limit at the current vehicle location is being adhered to. Various parameters such as the speed, direction, location, vehicle weight, temperature and cargo liquid volume may be sensed and data is stored in a memory located in the system controller board 12. The data stored may be analysed by the electronic device 1 or remotely at the remote monitoring station 8.

It will be appreciated that the modular electronic device 1 will have a micro-processor for processing the information. It will also be appreciated that many communication options can be integrated into the present invention. Further the sensor board 13 can be provided with Input / Output ports with display facilities to show their function.

It will be noted that the panel 11 can display to the driver of a vehicle that the vehicle is exceeding the speed limit in a particular zone or location either by visual or audio means. A head-up display could be provided for showing this information.

The electronic devices 1 of the invention can collect and store other information to provide additional information like car speed and acceleration and deceleration co-ordinated with electronic maps and speed limits for an emergency call on sensing a collision to ensure better control over large fleets of vehicles, weight measurement of goods carrying vehicles and heavy vehicles, record of number of miles as well as notifying when a service is due for the vehicle.

In the present invention when the term vehicle is used, it is used to encompass cars, motor cycles, trucks, buses and trains or any other vehicle which can be used for transport.

It will be appreciated that speed data obtained from the GPS receiver 15 is accurate and importantly is not vulnerable to outside interference or mechanical failure or fault.

This is particularly important to ensure the integrity of the data and that it has not been interfered or tampered with.

It will be appreciated that various aspects of the invention may be embodied on a computer that is running a program or program segments originating from a computer readable or usable medium, such medium including but not limited to magnetic storage media (e.g. ROMs, floppy disks, hard disks, etc.), optically readable media (e.g. CD-ROMs, DVDs, etc.) and carrier waves (e.g. transmissions over the internet). A functional program, code and code segments, used to implement the present invention can be derived by a skilled computer programmer from the description of the invention contained herein.

It will be appreciated therefore that a computerised program may be provided providing program instructions which, when loaded into a computer, will constitute the means in accordance with the invention and that this computer program may be embodied on a record medium, a computer memory, a read only memory or carried on an electrical carrier signal.

In the specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms "includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation.

The invention is not limited to the embodiments hereinbefore described but may be varied in both construction and detail within the scope of the appended claims.

CLAIMS

1. A method of profiling operation of a vehicle over a period of time for insuring the vehicle comprising an electronic device located within the vehicle and communication means for communicating data from the electronic device to a profile database stored at a remote monitoring station comprising the steps of:

monitoring a plurality of parameters representative of an operating state of the vehicle, said parameters including the location of the vehicle and the corresponding speed of the vehicle at said location, said measured speed and location data being determined using a GPS receiver independent of vehicle operator control, said parameters being measured at selected time intervals,

storing measured parameter data for the vehicle at selected time intervals in the electronic device;

establishing a communication link between the electronic device and the remote monitoring station;

transmitting the stored measured parameter data to the remote monitoring station;

generating a report profile of the vehicle operation from the transmitted data; and

calculating from the report profile an insurance premium for insuring the vehicle.

2. A method as claimed in claim 1 comprising the further steps of:

adjusting the selected time intervals between recordal of measured parameters in response to the measured speed of the vehicle.

3. A method as claimed in claim 2 including the step of adjusting the selected time intervals in inverse proportion to the speed of the vehicle.

4. A method as claimed in any preceding claim including the step of adjusting the selected time intervals in response to the rate of change of the speed of the vehicle.

5. A method as claimed in claim 4 including the step of adjusting the time intervals in inverse proportion to the rate of change of the speed of the vehicle.

6. A method as claimed in claim 4 or 5 including:

sensing a sudden deceleration of the vehicle;

recording the measured parameters at reduced time intervals in response to a sensed sudden deceleration of the vehicle;

7. A method as claimed in claim 4 or 5 including:

sensing a sudden acceleration of the vehicle;

recording the measured parameters at reduced time intervals in response to a sensed sudden acceleration of the vehicle;

8. A method as claimed in any preceding claim comprising the further steps of:

periodically sending an SMS message from the remote monitoring station to the electronic device;

polling the stored measured parameter data;

sending an SMS message containing the stored measured parameter data from the electronic device to the remote monitoring station.

9. A method as claimed in any preceding claim comprising the further step of establishing a communication link between the electronic device and the remote monitoring station using a GPRS platform.

10. A method as claimed in any preceding claim comprising the further steps of:

storing at the remote monitoring station a GPS map having defined maximum speed limits associated with each location on the map,

comparing the transmitted measured location data for the vehicle with the GPS map and assigning the relevant maximum speed limit to each measured location,

generating the report profile of the vehicle operation indicating the measured speed of the vehicle, the associated location of the vehicle and the maximum allowable speed limit for that location.

11. A vehicle monitoring system, including:

means for measuring a number of pre-selected parameters associated with operation of the vehicle,

data storing means connected to the measuring means for recording data relating to said measured parameters,

means for polling the measuring means and recording the measured parameters received at selected time intervals in the data storing means,

said parameters including the location of the vehicle and the corresponding speed of the vehicle at said location, a GPS receiver

being provided for determining both of said measured location and measured speed of the vehicle,

means for communicating recorded data from the data storing means to a remote monitoring station.

12. A system as claimed in claim 11 wherein means is provided for adjusting the selected time intervals between recordal of data in response to the measured speed of the vehicle.

13. A system as claimed in claim 12 wherein the selected time intervals are inversely proportional to the speed of the vehicle.

14. A system as claimed in any of claims 11 to 13 wherein means is provided for adjusting the selected time intervals between recordal of data in response to the measured rate of change of speed of the vehicle.

15. A system as claimed in claim 14 wherein the selected time intervals are adjustable in inverse proportion to the rate of change of the speed of the vehicle.

16. A system as claimed in claim 14 wherein means is provided for sensing a sudden deceleration of the vehicle, said means being operably connected to the means for adjusting the time interval between recordal of data to reduce said time intervals in response to a sudden deceleration of the vehicle.

17. A system as claimed in claim 14 wherein means is provided for sensing a sudden acceleration of the vehicle, said means being operably connected to the means for adjusting the time interval between recordal of data to reduce said time interval in response to a sudden acceleration of the vehicle.

18. A system as claimed in any of claims 11 to 17 wherein the communicating means is an SMS system.

19. A system as claimed in any of claims 11 to 17 wherein the communicating means is a GPRS system.

20. A system as claimed in any of claims 11 to 19 wherein the remote monitoring station has a GPS map with defined maximum speed limits associated with each location on said GPS map,

means for comparing measured vehicle location data communicated to the remote monitoring station with the GPS map and assigning the relevant maximum speed limit to each measured location, and

means for generating a report profile of vehicle operation indicating the measured speed of the vehicle, the associated measured location of the vehicle and the maximum speed limit for said measured location.

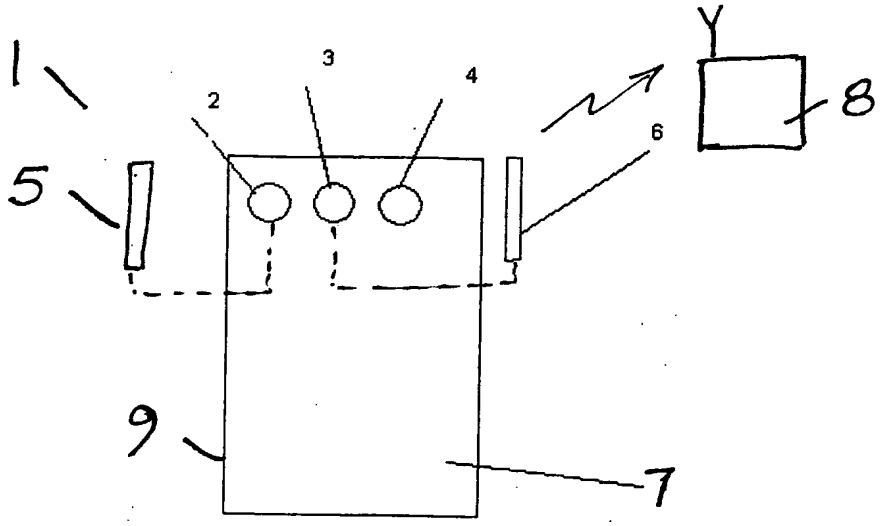
1
2
3
4
5
6
7
8
9

Fig 1

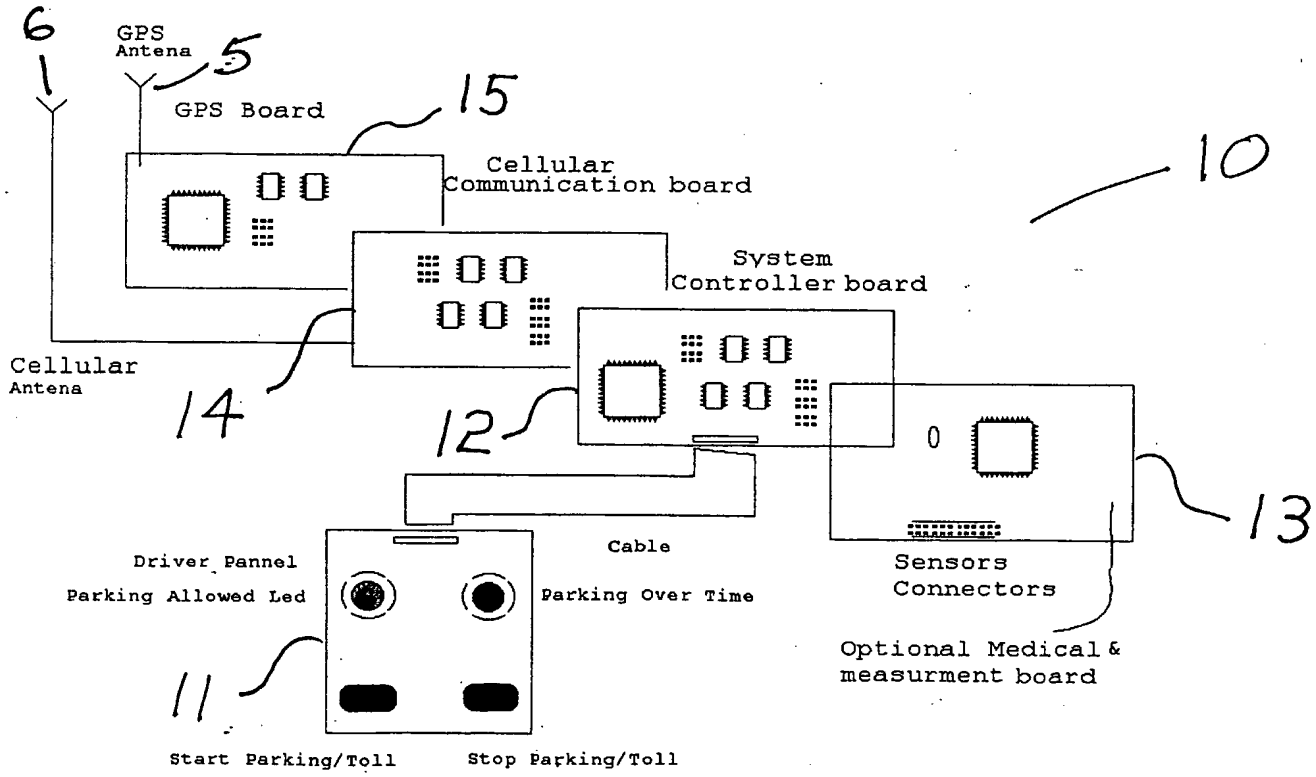
6
GPS Antena
5
GPS Board
15
Cellular Communication board
10
System Controller board
Cellular Antena
14
12
13
Cable
Driver Pannel
Parking Allowed Led
Parking Over Time
Sensors Connectors
Optional Medical & measurment board
11
Start Parking/Toll
Stop Parking/Toll

Fig 2

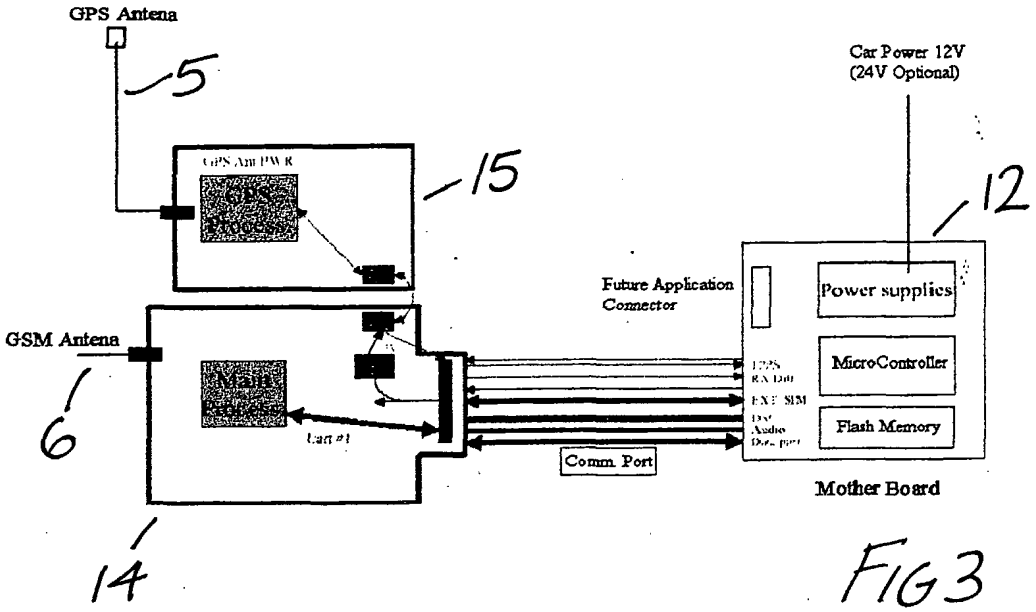
GPS Antena
5
15
Car Power 12V
(24V Optional)
12
Future Application
Connector
Power supplies
MicroController
Flash Memory
GSM Antena
6
Comm. Port
Mother Board
14

FIG3

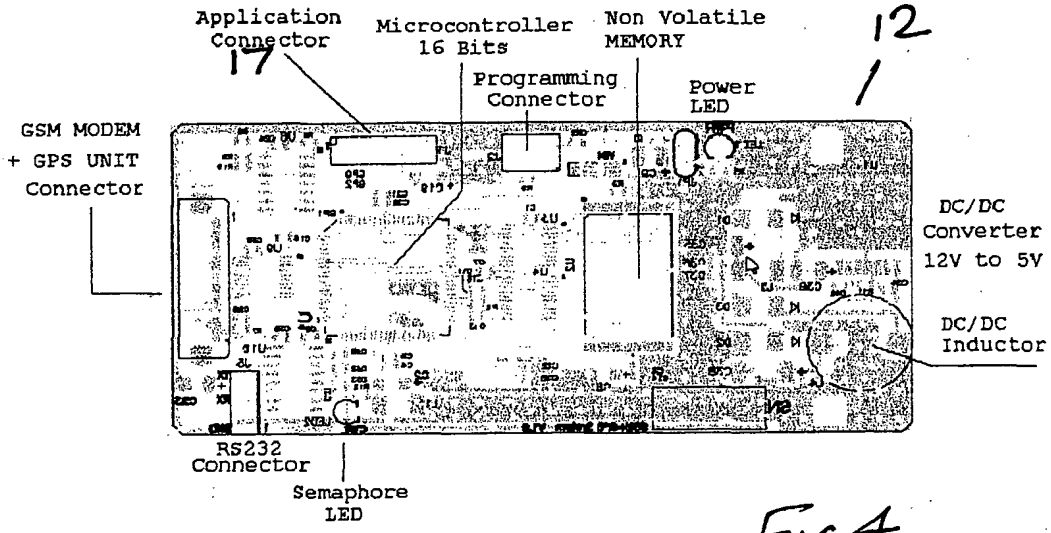
Application
Connector
17
Microcontroller
16 Bits
Non Volatile
MEMORY
Programming
Connector
Power
LED
12
GSM MODEM
+ GPS UNIT
Connector
DC/DC
Converter
12V to 5V
DC/DC
Inductor
RS232
Connector
Semaphore
LED

FIG4

Summary Report

Driving Profile

84.34% Time spent driving within guidelines
8.62% Up to 10 mph above guidelines
4.69% Between 10 and 20 mph above g/lines
1.33% Between 20 and 30 mph above g/lines
0.99% Between 30 and 40 mph above g/lines
0.00% Over 40 mph above guidelines

TABLE1

Maximum Speeds

Zone	Speed
30 MPH	65.5
40 MPH	65.7
50 MPH	63.5
60 MPH	68.5
70 MPH	79.8

TABLE 2

Vehicle Moving

	Hours Between		
	7:00-23:00	23:00-7:00	Total
2-10-02	2.13	0.15	2.28
3-10-02	2.60	0.05	2.65
4-10-02	3.97	0.05	4.02
5-10-02	4.98	0.01	4.99
6-10-02	3.44	0.05	3.49

TABLE3

Vehicle Parked

	Hours Between		
	7:00-23:00	23:00-7:00	Total
Haddington Rd	6.84	0.00	6.84
Kildare	0.35	0.00	0.35
Lr Mount St	17.82	0.00	17.82
Maynooth	32.37	37.12	69.49
Other	0.82	0.00	0.82
Palmerstown	4.74	0.00	4.74

TABLE4

Sudden Acceleration

Date	Time	From MPH	To MPH	Time Taken in Seconds
05/10/02	11:14:51	20.3	48.8	5
05/10/02	10:40:57	12.0	38.3	7
04/10/02	19:42:52	17.0	38.0	6
05/10/02	13:44:34	9.0	36.9	8

TABLE5

Harsh Braking

Date	Time	From MPH	To MPH	Time Taken in Seconds
04/10/02	6:46:14	38.4	3.0	5
04/10/02	0:18:23	40.2	14.0	4
06/10/02	8:25:17	32.8	2.8	5
05/10/02	1:14:55	48.8	25.2	4
05/10/02	3:08:31	28.8	0.6	5
05/10/02	4:54:53	31.0	3.2	5

TABLE6

Area of Main Use

Location	Use %
Kildare	30.36
DublinCounty	25.41
DublinCity	9.78
Meath	9.76
Galway	9.75
Westmeath	8.14
Kilkenny	2.70
Roscommon	1.85
Carlow	1.66
Offaly	0.58

TABLE7

Snapshot Graph

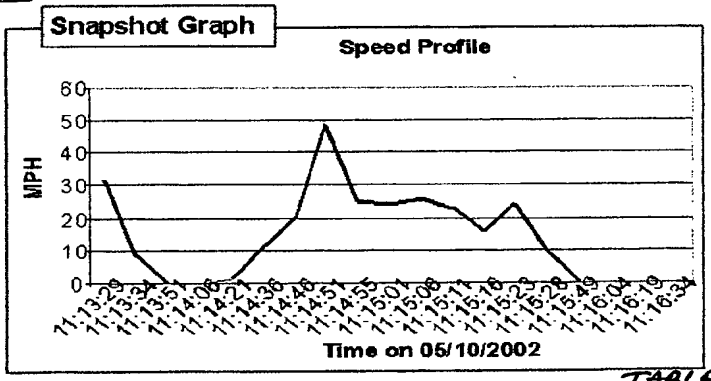

TABLE8

Data Snapshot

```
+53°21'25.64,-06°22'12.66,10:13:29,05:10:02,,111.8,032.1,06
+53°21'24.94,-06°22'09.98,10:13:34,05:10:02,,114.7,008.7,05
+53°21'24.98,-06°22'09.72,10:13:51,05:10:02,,012.4,000.0,04
+53°21'25.06,-06°22'09.72,10:14:06,05:10:02,,226.8,000.1,04
+53°21'25.12,-06°22'09.61,10:14:21,05:10:02,,104.8,001.3,04
+53°21'22.28,-06°22'07.54,10:14:36,05:10:02,,170.3,011.4,07
+53°21'18.83,-06°22'04.73,10:14:46,05:10:02,,179.2,020.3,09
+53°21'15.15,-06°22'04.48,10:14:51,05:10:02,,175.4,048.8,08
+53°21'12.72,-06°22'04.87,10:14:55,05:10:02,,184.8,025.2,06
+53°21'09.85,-06°22'05.71,10:15:01,05:10:02,,188.7,024.4,07
+53°21'06.82,-06°22'06.52,10:15:06,05:10:02,,189.7,025.8,05
+53°21'03.86,-06°22'07.19,10:15:11,05:10:02,,188.7,022.9,06
+53°21'03.12,-06°22'09.78,10:15:16,05:10:02,,274.6,015.8,07
+53°21'04.07,-06°22'16.26,10:15:23,05:10:02,,283.2,024.4,09
```

TABLE9

Map of Snapshot

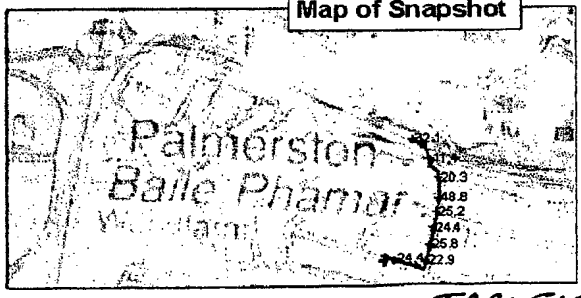

TABLE10

FIG5

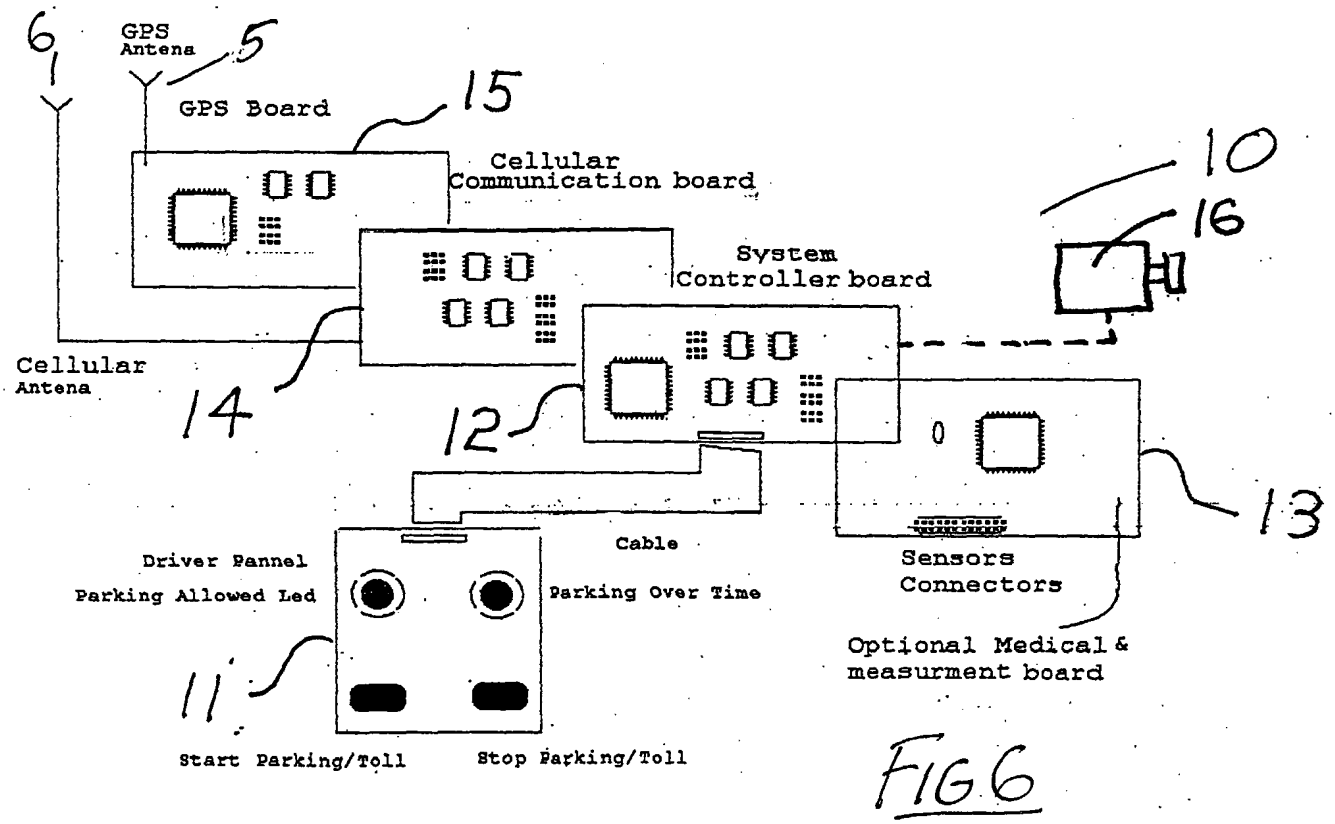
6
GPS
Antena
5
GPS Board
15
Cellular
Communication board
10
16
System
Controller board
Cellular
Antena
14
12
13
Cable
Driver Pannel
Parking Allowed Led
Parking Over Time
Sensors
Connectors
Optional Medical &
measurment board
11
Start Parking/Toll
Stop Parking/Toll

FIG 6

INTERNATIONAL SEARCH REPORT

Inte nal Application No
PCT/IE 03/00028

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/60 G08G1/123 G07C5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G08G G07C G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 1 160 707 A (PROGRESSIVE DIRECTRAC SERVICE) 5 December 2001 (2001-12-05) paragraphs '0001!,'0018!,'0029!,'0030! paragraphs '0053!-'0056! figures 2,3,5 --- -/--	1,8,11, 18 2-7,9, 10, 12-17, 19,20

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 July 2003	15/07/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Massalski, M

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INTERNATIONAL SEARCH REPORT

Inte ›nal Application No
PCT/IE 03/00028

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	paragraphs '0001!-'0004! paragraphs '0008!-'0012! paragraphs '0022!-'0032! paragraphs '0056!-'0058! figures 1-3,7	2-10, 12-20
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A	column 2, line 27,28,62,63 column 4, line 19-63 column 8, line 14-41 column 12, line 59-67 figures 1,4,20	2-10, 12-20
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A	paragraphs '0063!,'0064!,'0084!,'0089!	1-10, 12-20
A	EP 0 890 937 A (BOSCH GMBH ROBERT) 13 January 1999 (1999-01-13) page 2, line 9-32	1,11
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P,A	page 2, line 30 -page 3, line 28 page 5, line 20 -page 6, line 5 figures 1,2	2-10, 12-20

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